

# **RELIABILITY-ENHANCING LAYERS FOR VERTICAL CAVITY SURFACE EMITTING LASERS**

## **ABSTRACT**

Vertical cavity surface emitting lasers (VCSELs) and methods of making the same are described. The VCSELs include reliability-enhancing layers that perform specific functions at one or more critical locations within a VCSEL structure to reduce or prevent defect formation and migration that otherwise might degrade  
5 VCSEL performance, for example, by increasing optical absorption in the mirror stacks or by degrading the electro-optic properties of the active region. In particular, the reliability-enhancing layers are configured to perform one or more of the following functions within the VCSEL structure: gettering (i.e., removing defects or impurities from critical regions), strain balancing (i.e., compensating  
10 the lattice mismatch in the structure to minimize strain), and defect suppression (i.e., creating alloys that reduce the formation of defects during growth or post-growth activities). By strategically positioning one or more appropriately configured reliability-enhancing layers with respect to an identified defect source, the invention enables VCSEL structures to be modified in a way that enhances the  
15 reliability and performance of VCSEL devices.